The result of these experiments was as follows:—

The wootz of the 1st cake reduced 0·139 its own weight of lead.
That of the 2nd ——— 0·125 ——— ———
——— 3rd ——— 0·120 ——— ———
——— 4th ——— 0·156 ——— ———
——— 5th ——— 0·102 ——— ———
Steel containing $\frac{1}{60}$ its weight of carbon 0·094 its own weight of lead.
White cast iron —— —— —— 0·228 ——— ———

From these experiments, the author says, it appears, that wootz contains a greater proportion of carbonaceous matter than the common sorts of cast steel, and that some particular cakes approach very near to the nature of cast iron. This, added to the imperfect reduction, seems to him quite sufficient to account for its refractory nature, and for the want of homogeneity in its texture.

Notwithstanding the above imperfections, Mr. Mushet thinks wootz possesses the radical principles of good steel, and that it is impossible not to have a very high opinion of the excellence of the ore from which it is produced; the possession of which, for the fabrication of steel and bar iron, would be an object of the highest importance. It is, he says, a subject of regret that such a source of wealth cannot be annexed to the dominions of this country; as in that case the East India Company might supply their settlements with an article superior in quality, and inferior in price, to any they send from this country.

Abstract of Observations on a diurnal Variation of the Barometer between the Tropics. By J. Horsburgh, *Esq. In a Letter to* Henry Cavendish, *Esq. F.R.S.* Read March 14, 1805. [*Phil. Trans.* 1805, *p.* 177.]

It appears from Mr. Horsburgh's journal, that in steady weather, within the tropics, a regular elevation and depression of the barometer takes place twice in every twenty-four hours, the greatest depression being about four o'clock morning and evening, and the greatest elevation being from eight in the morning till noon, and from nine or ten in the evening till midnight.

In a letter which accompanies the journal, dated Bombay, April 20th, 1804, Mr. Horsburgh says he has observed, since his arrival in India, that the atmosphere appears to affect the barometer differently at sea from what it does on shore. As a proof of this, Mr. Horsburgh gives a series of observations, made on two barometers, one by Troughton, the other by Ramsden, of which the following is an abstract.

From the time of leaving the Land's End, on April 19th, 1802, the mercury was fluctuating and irregular, till April 29th, lat. 26° N., long. 20° W., when it constantly performed two elevations and two depressions every twenty-four hours. These Mr. Horsburgh calls equatropical motions. From lat. 26° to 10° the difference in the high and low stations of the mercury was not so great as it was from

the latter latitude across the equator, and from thence to lat. 25° S. Within the last-mentioned limits, the difference was very considerable, being generally from five to nine hundredths of an inch, both in the day and the night.

When the ship arrived in lat. 28° S., long. 27° W. (June 7th), the mercury no longer performed the equatropical motions, but was irregular and fluctuating until July 11th, when the ship was in latitude 27° S., long. 51° E. The equatropical motions then took place again, and continued with great regularity while the ship sailed up the Madagascar Archipelago, and across the equator, until the arrival of the ship at Bombay, on the 31st of July.

On the 6th of August the barometers were placed on shore, and, from that day to the 12th, the mercury appeared to have a small tendency towards the equatropical motions; from the latter day to the 22nd of the same month, that tendency was so much diminished as to be generally imperceptible.

On the 23rd of August the barometers were again put on board the ship, which left the harbour of Bombay on the 26th. The mercury then immediately began again to perform the equatropical motions, and continued them, with great uniformity, down the Malabar coast, across the bay of Bengal, in the strait of Malacca, and through the China Sea, until the ship arrived in Canton river, on the 4th of October. The mercury then became nearly stationary, or, if it showed at times a small inclination towards the equatropical motions, such inclination was not by any means so perceptible as at sea.

The ship remained at Canton till the 2nd of December, and, although there appeared at times a slight tendency in the mercury to perform the equatropical motions, the rise and fall was in general so small as to be frequently imperceptible; but, on the departure of the ship from Canton river, the motions instantly took place, and continued until the ship arrived in Bombay harbour, on the 11th of January 1803.

From that day to the 23rd of May, the ship remained at Bombay; and during the whole of that time, no tendency towards the equatropical motions worth noticing could be perceived. On the above-mentioned day, the instant the ship left the harbour, the motions of the mercury again took place, and continued, but not always with equal regularity, until the 2nd of July, when the ship again entered Canton river.

During the time the ship continued at Canton, no appearance of the motions here treated of, worth remarking, could be perceived; but as soon as the ship left the river, on the 13th of September, they again took place, and continued until the 13th of October; when, upon entering the Strait of Sincapore, they appeared to be diminished, but re-assumed their usual appearance as soon as the ship had passed the narrow part of the strait. On the 21st of October the ship arrived in the harbour of Prince of Wales's Island, and a great diminution again took place in the equatropical motions; but upon

leaving the harbour, on the 5th of November, they again returned, and continued, with their usual regularity, until the arrival of the ship at the entrance of Hoogly river, on the 3rd of December. While the ship continued in the lower part of that river, a slight tendency to the equatropical motions might be perceived; but up the river, at Diamond harbour, the mercury was nearly stationary the whole twenty-four hours.

On the 13th of January 1804, after clearing Hoogly river, the equatropical motions again returned, and continued until the arrival of the ship at Bombay, on the 12th of February; from which day to the 18th, when the journal ceases, no signs of the above motions could be perceived.

Concerning the Differences in the magnetic Needle, on Board the Investigator, arising from an Alteration in the Direction of the Ship's Head. By Matthew Flinders, *Esq. Commander of His Majesty's Ship Investigator. In a Letter to the Right Hon. Sir* Joseph Banks, *K.B. P.R.S.* Read March 28, 1805. [*Phil. Trans.* 1805, *p.* 186.]

In the years 1801 and 1802, while Capt. Flinders, on board the Investigator, was surveying the south coast of New Holland, he observed a difference in the direction of the magnetic needle, for which there appeared no other cause than that of the ship's head being in a different direction. The compasses made use of on board the above-mentioned ship were of Walker's construction, one excepted, which was made by Adams; and it appears, from a table of observations given by Capt. Flinders, that some of the variations here treated of were 4° less, and others 4° greater than the truth. It also appears, that when this error was to the west, the ship's head was to the east, or nearly so; when the error was eastward, the ship's head was in a contrary direction; and when the observations agree best with those taken on shore, which may be considered as having the true variation, the ship's head was nearly north or south. A minute inspection of the table seems to favour the opinion, that the excess or diminution of the variation was generally in proportion to the inclination of the ship's head, from the magnetic meridian, on either side.

Capt. Flinders, having ascertained the certainty of a difference in the compass, arising from an alteration in the point steered, thought it necessary, when he wanted a set of bearings from a point where the ship tacked, to take one set just before and another immediately after that operation. Several specimens of the manner in which these bearings were taken are given; also a specimen of the plan he followed in protracting such bearings: these specimens are in the form of tables, and are not of a nature to be abridged.

With respect to the cause of the differences here treated of, Capt. Flinders offers the following conjectures:—

1st, That the attractive power of the different substances in a ship, which are capable of affecting the compass, is brought into a sort of focal point nearly in the centre of the ship, where the shot are de-